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ON THE LINGUAL DENTITION AND JAW OF CERTAIN TERRESTRIAL
PULMONATA FROM THE UNITED STATES, WITH REMARKS ON THEIR
SYSTEMATIC VALUE.

BY THOMAS BLAND AND W. G. BINNEY.

The character of the jaw and lingual dentition of the various genera and subgenera of our land shells is now so well known, and apparently so constant, that we have not thought it necessary to give full descriptions in each case. We simply refer to a published description or figure under each genus or subgenus, unless some unusual feature has been observed. The number of ribs upon the jaw is given approximately when there is a difficulty in deciding whether certain stages of thickening of the material of the jaw shall be counted as rudimentary ribs or not.

MACROCICLIS DURANTI, Newcomb.

Los Angeles, California, Mr. Henry Hemphill.

On examining the lingual membrane, we find it does not agree with that of *Hyalina* or *Zonites*, but with that of *Macrocyclus Vancouverensis*, *sportella* and *concava*. The species must therefore be recognized as a *Macrocyclus*.

The jaw was injured in extraction and imperfectly examined. It seems, however, to have the usual characteristics of the genus.

LIMAX CAMPESTRIS, Binney.

New Jersey, W. G. Binney.

Jaw and lingual membrane as usual in the genus.

ZONITES LIMATULUS, Ward.

Near Cincinnati, Ohio. Mr. A. G. Wetherby.

The species has the longitudinal furrows along the side; above the foot, and the caudal mucus slit, as in *Zonites suppressus*, (see our fig. 524 on p. 292 of Land and Fresh-water Shells of N. A., I.) In two individuals examined we found the sac and dart as figured by Leidy in *Z. ligerus* (Terr. Moll., I, pl. xii. fig. 3).

Jaw and lingual membrane as usual in the genus.

VITRINA PFEIFFERI, Newcomb.

Lake Tahoe, California, Dr. J. G. Cooper.

Jaw and lingual membrane as usual in the genus (see our fig. 21, 22, on p. 26, l. c.). About ten lateral teeth. Marginals bluntly bifid as usual.

VITRINA EXILIS, Morel.

Petropaulouski, W. H. Dall. The species is also found in Alaska.

Jaw and lingual membrane as usual in the genus, the former with ends somewhat recurved as in our figure of *Zonites arboreus* (l. c. p. 33). About seven lateral teeth.

HELIx MOOREANA, W. G. Binney. (*Polygyra*.)

Bosque County, Texas. Mr. Hugo W. Ericsson.

Jaw¹ with about fifteen, adjoining, broad ribs, denticulating either margin.

Lingual membrane as in *Polygyra*.¹

HELIx HAZARDI, Bland. (*Polygyra*.)

Munroe Co., Tennessee, Miss Annie E. Law.

Jaw as usual in *Polygyra*, ribs adjoining, stout, denticulating either margin.

Lingual membrane as in *H. auriculata* (see our fig. l. c.).

HELIx AURIFORMIS, Bland. (*Polygyra*.)

Savannah, Georgia.

Jaw with ribs as usual in the subgenus—see last species.

Lingual membrane as usual in the subgenus. (See *H. Mooreana*, above.)

HELIx HIRSUTA, Say. (*Stenotrema*.)

New Jersey, T. Bland.

Jaw as usual in the subgenus.² Lingual membrane already described by us. (l. c. p. 119, fig. 197.)

HELIx SPINOSA, Lea. (*Stenotrema*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

Jaw as usual in *Stenotrema*.²

Lingual membrane as usual in the subgenus.²

HELIx RUGELI, Shuttleworth. (*Triodopsis*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

¹ See our figures l. c. p. 87 and 92.

² The jaw in *Stenotrema* is arcuate, ends blunt, anterior surface with crowded, broad ribs, denticulating either margin. See our figure of the jaw of *H. monodon*, l. c. p. 122, fig. 204. For lingual membrane, see fig. 205.

Jaw with about ten ribs; as usual in the subgenus.¹

Lingual dentition as usual.¹

HELIX FALLAX, Say. (*Triodopsis*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

Lingual membrane and jaw as usual in *Triodopsis*,¹ the latter with about fourteen ribs.

HELIX TRIDENTATA, Say. (*Triodopsis*.)

Same locality as last.

Jaw as usual in the subgenus.¹

Lingual membrane already figured by us. (l. c. fig. 220, p. 130.)

HELIX HOPETONENSIS, Shuttleworth. (*Triodopsis*.)

Charleston, S. C. Mr. W. G. Mazyck.

Jaw with over ten ribs; as usual in the subgenus.¹

Lingual membrane as usual.

HELIX DENTIFERA, Binney. (*Mesodon*.)

Mohawk, New York. Dr. James Lewis.

Jaw with fourteen ribs; as usual in the subgenus.²

Lingual membrane as usual.² The marginal teeth remind us of those of *Helix thyroides* (l. c. p. 148, fig. 252), but the inner denticle is more obtusely pointed. The figure referred to is liable to mislead. The marginals are subquadrate (not aculeate), with one long, oblique, sharply pointed denticle, much more produced than usual in the genus.

HELIX ROËMERI, Pfr. (*Mesodon*.)

Bosque Co., Texas. Mr. Hugo W. Ericsson.

Animal externally as in *H. thyroides*, *dentifera*, etc.

Jaw and lingual membrane as usual in the subgenus,² the former with over seven ribs.

HELIX ELEVATA, Say. (*Mesodon*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

¹ In *Triodopsis* the jaw is arcuate, ends blunt, anterior surface with stout, adjoining ribs, which denticulate either margin. See our fig. 214, p. 127, l. c. For lingual dentition, see fig. 215.

² In *Mesodon* the jaw is arcuate, ends blunt; anterior surface with stout, separated ribs, denticulating either margin. See our fig. 231, on p. 137, l. c. The lingual dentition is figured on p. 138, fig. 232. The central and lateral teeth are obtuse, short, stout, with obsolete side denticles to the reflected cusps.

Lingual membrane and jaw as usual in the subgenus,¹ the latter with over twelve ribs.

HELIX GERMANA, Gould. (*Mesodon*.)

California, Mr. Henry Hemphill.

Jaw more resembling the type usual in the subgenus *Stenotrema* than *Mesodon*, the ribs, eleven in number, being broad and crowded.

Lingual membrane as usual in *Helix*.

There are forms of *H. germana* closely connecting the species with *H. Columbiana*, Lea. The jaw of the latter is described by Dr. Cooper as strongly arched, with eight broad ribs.

HELIX GRISEOLA, Pfr. (*Fruticicola*.)

Bosque Co., Texas. Mr. Hugo W. Ericsson.

Jaw with about ten broad, crowded ribs, denticulating the cutting margin; upper margin with membranous attachment. The jaw is somewhat of the type figured by Moquin Tandon for that of *Helix hispida*. (See our fig. 274, p. 159, l. c.)

Lingual membrane as usual in the genus *Helix*. The reflected cusps of the teeth are short, stout. Marginals with blunt denticulations.

HELIX SEQUOICOLA, J. G. Cooper. (*Arionta*.)

Jaw as usual in the subgenus.² Ribs from four to six.

Lingual membrane as usual in the subgenus. Central and lateral teeth with short, stout cusps. Marginals with two bluntly bifid denticles.

HELIX EXARATA, Pfr. (*Arionta*.)

Santa Cruz, California, Mr. Henry Hemphill.

Lingual membrane and jaw as usual in the subgenus,² the latter with six ribs.

HELIX TRASKI, Newcomb. (*Arionta*.)

Los Angeles, California, Mr. Henry Hemphill.

Lingual membrane and jaw as usual in the subgenus,² the latter with eight ribs, five stout, three slight.

¹ See note 1 to p. 242.

² In *Arionta* the jaw is strongly arched, ends blunt; anterior surface with a few, stout, distant ribs, projecting far beyond, and deeply scalloping either margin. See our figure of that of *H. redimita* in Am. Journ. of Conch. VI. pl. ix. fig. 11. For lingual dentition, see our fig. 284, p. 164, of Land and Fresh-water Shells of N. A., I.

HELIX AYRESIANA, Newcomb. (*Arionta*.)

San Miguel Island, California. Mr. Henry Harford.

Animal long and slender, smoky-white, covered with white coarse granulations running longitudinally down the back, one line of granulations very prominent and central, bordered on either side with a deep furrow. Also oblique lines of granulations running down the sides of the foot. Foot dirty-white below. Tail short, broad, pointed. Some individuals are darker, with a purplish tinge.

Jaw and lingual membrane as usual in the subgenus,¹ the former with six ribs.

HELIX RUFICINCTA, Newcomb. (*Arionta*.)

Catalina Island, California. Mr. Henry Hemphill.

Jaw more like the type common in *Mesodon* than in *Arionta*, *i. e.*, arcuate rather than arched, margins rather pectinated than scalloped by the ends of the ribs, which are about ten in number.

Lingual membrane as usual in the subgenus.¹

HELIX KELLETTI, Forbes. (*Arionta*.)

Catalina Island, California. Mr. Henry Hemphill.

Jaw and lingual membrane as usual in the subgenus,¹ the former with about six ribs.

HELIX NEWBERRYANA, W. G. Binney. (*Glyptostoma*.) See our plate I., fig. 12, 3.

San Diego, California. Mr. Henry Hemphill.

This species belongs to no described section or subgenus, we propose for it, therefore, the name *Glyptostoma*, (*γλυπτος, στωμα*), from the peculiar sculptured lines which revolve upon the parietal wall.

GLYPTOSTOMA, subgen. nov.

Testa late umbilicata, depressa, ruguloso-striata, solida, anfractus 6, ultimus depresso-globosus, antice non descendens; apertura obliqua, subcircularis; peristoma simplex, acutum, intus incrassatum, marginibus approximatis, columellari brevi, vix reflexiusculo.

Maxilla arcuata, costis validis distantibus (circa 16) exarata; margines valde dentati.²

Lamina lingualis ut in *Helice* videtur; dentes marginales subquadrati.

¹ See note 2 to p. 243.

² See our plate I., fig. 1, and the explanation of the plate.

Systema sexuale simplex;¹ desunt sagitta, bursa, flagellum, et vesica multifida. Orificium ut in *Helice* positum.

Externally, the animal resembles that of *Helix*. It is bluish-slate colored.

We have already described and figured the lingual dentition (see Am. Journ. Conch., VII. 190, pl. xvii. fig. 3, 4). The jaw is long, low, slightly arcuate; ends blunt; anterior surface with about sixteen stout, separated ribs, scalloping either margin. The jaw is lower, less arcuate and longer than in *Arionta*. Its ribs resemble those of that subgenus in projecting far beyond and scalloping the margins of the jaw, but they are much more numerous.

This description applies only to the more perfect form of the jaw (fig. 1 of our plate), noticed only in one individual. In several other individuals the ribs on the jaw were much more narrow and less projecting at the upper and lower margins. There is more difference between these than is usually found in different individuals of the same species.

SUCCINEA CAMPESTRIS, Say.

Charleston, S. C. Mr. W. G. Mazyck.

Jaw as usual in the genus; the anterior surface has no decided ribs.

Lingual membrane as usual in the genus (see our figure on p. 267, l. c.).

SUCCINEA LINEATA, W. G. Binn.

Little Colorado River, Arizona. Dr. E. Palmer.

Jaw and lingual membrane as usual in the genus, the former without distinct anterior ribs.

Having published many descriptions and figures of the jaws and lingual dentition of mollusks, mostly terrestrial, we here propose to review our work, to see how nearly our observations agree with the generic descriptions published by Albers and von Martens for the various genera. We give below a list of our descriptions published previous to 1873 in other works than the Land and Fresh-water Shells of North America, Parts I. II. and

¹ See our plate, fig. 3. There is one accessory organ, of use unknown to us. See below, explanation of plate.

III., and the second edition of the Invertebrata of Massachusetts. In cases where we have not published together, the name of the separate author is given.

PULMONATA GEOPHILA.

(a.) *Without jaw.*

Gonospira sulcata, Müller. Ann. Lyc. N. H. of N. Y., X. 222. See next species.

Gonospira palanga, Fér. Am. Journ. Conch., V. 37, pl. xi. fig. 1, photograph.

Lingual membrane quite distinct from *Pupa*, in which it is placed by von Martens.

Glandina rosea, Fér. Am. Journ. Conch., VI. 202, fig. 1.

(b.) *With jaw in one single piece.*

?**Hyalina Baudoni**, Petit. (*Mörchia*.) Am. Journ. Conch., VII. 175.

There are no lateral teeth as usual in *Hyalina*. The lingual is like that of *Macrocyclus*, to which genus we believe it belongs.

Macrocyclus Voyana, Newc. Am. Journ. of Conch., VII. 175.

We have shown the dentition to be peculiar in this genus.

Stenopus Guildingi, Bland. Ann. Lyc. N. H. of N. Y., VIII. 158, fig. 3. T. Bland.

Nanina Calias, Benson. Am. Journ. Conch., VII. 188, pl. xvii. fig. 6, 8.

Lingual membrane not given in Albers' ed. 2. We have shown that it differs from Troschel's figures.

Nanina cultrata, Gould. Am. Journ. Conch., VII. 189.

Nanina inversicolor, Fer., **leucostyla**, Pfr., **rufizonata**, H. Ad., **millaris**, Pfr. Ann. Lyc. N. H. of N. Y., X. 169.

All shown by us not to belong to the genus *Helix*.

Limax flavus, Lin. Copied in Am. Naturalist, IV. 167, fig. 42, 43. W. G. B.—Ann. Lyc. N. H. of N. Y., IX. 285, fig. 6.

Limax maximus, Lin. Am. Journ. Conch., VI. 203.

Zonites capsella, Gould. Am. Journ. Conch., VII. 174.

Zonites ligerus, Say. Am. Journ. Conch., VII. 174.

Zonites gularis, Say. Am. Journ. Conch., VII. 174.

Zonites intertextus, Say. Pr. Phila. Ac. N. Sc., 1872, 135.

Zonites demissus, Binney. Proc. Phila. Ac. N. Sc., 1872, 135.

Zonites lasmodon, Phillips. Proc. Phila. Ac. N. Sc., 1872, 135.

Zonites internus, Say. Proc. Phila. Ac. N. Sc., 1872, 135.

Zonites lævigatus, Pfr. Ann. Lyc. N. H. of N. Y., IX. 284, fig. 4.—Proc. Ac. N. Sc. Phila., 1872, 135.

Pallifera dorsalis, Binney. Proc. Phila. Ac. N. Sc., 1872, 137.

Hemphillia glandulosa, Ann. Lyc. N. H. of N. Y., X. pl. ix. fig. 15, 16, 17.

Ariolimax Columbianus, Gould. Am. Journ. Conch., I. 48, pl. vi. fig. 12, 13. W. G. B.

Veronicella Floridana, Binney. Ann. Lyc. N. H. of N. Y., IX. 285, fig. 5.

Veronicella. Am. Journ. Conch., VII. 163, pl. xii. fig. 7.

Bulimus oblongus, Müll. (*Borus*.) Am. Journ. Conch., VII. 180.

Bulimus pardalis, Fer. (*Dryptus*.) Am. Journ. Conch., VII. 181.

Bulimus marmoratus, Dunker. (*Dryptus*.) Am. Journ. Conch., VII. 181.

Jaw not examined.

Bulimus multicolor, Rang. (*Anthinus*.) Am. Jour. Conch., VI. 208. The jaw is ribless, thus differing from description of *Bulimus*.

Bulimus Hanleyi, Pfr. (*Orphnus*.) Am. Journ. Conch., VI. 208.

Jaw quite unlike generic description. Strongly arched, with a median projection, ribless.

Bulimus magnificus, Grat. (*Orphnus*.) Am. Journ. Conch., VI. 208. Jaw quite like generic description.

Bulimus odontostomus, Sowb. (*Macrodonates*.) Am. Journ. Conch., VI. 209.

The jaw differs from the generic description in being ribless.

Bulimus aulacostylus, Pfr. (*Eurytus*.) Ann. Lyc. N. H. of N. Y., X. 222.

The jaw as in *Bulimulus*.

Bulimus auris-Sileni, Born. (*Pelecychilus*.) Same as last species.

Cochlostyla fulgetrum, Brod. Am. Journ. Conch., VII. 180.

Jaw not described in Albers and v. Martens. We find it with ribs.

Limicolaria Numidica, Reeve. Am. Journ. Conch., VII. 181.

Jaw differs from the generic description in being ribless.

Eucalodium Newcombianum, Gabb (= **Berendtia Taylori**, Pfr.). Ann. Lyc. N. H. of N. Y., VIII. 175, fig. 3. T. Bland.

Stenogyra decollata, Lin. Am. Journ. Conch., VII. 183.

Stenogyra gonostoma, Gundl. Am. Journ. Conch., VII. 183.

Stenogyra octona, Chemn. Am. Journ. Conch., VII. 183.

We have shown the peculiar characters of the dentition constant in the three species.

Clausilia tridens, Chemn. Am. Journ. Conch., VII. 28, pl. ii. fig. 1-5, 7, 8.

Amphibulima patula, Brug. Am. Journ. Conch., VII. 186, pl. xvii. fig. 1, 2, lingual membrane. Jaw in Ann. Lyc. N. H. of N. Y., X. 225, pl. xi., fig. 8.

We have shown the jaw and dentition to be unlike *Succinea*.

Pellicula ? appendiculata, Pfr. Ann. Lyc. N. H. of N. Y., X. 206, pl. ix. fig. 2, 9-11.

Bulimulus pallidior, Sowb. Ann. Lyc. N. H. of N. Y., IX. 282, fig. 2, lingual.

Bulimulus laticinctus, Guppy. Ann. Lyc. N. H. of N. Y., X. 81, pl. ii. fig. 1, 5.

The teeth are peculiarly modified.

Bulimulus Bahamensis, Pfr. Ann. Lyc. N. H. of N. Y., X. 82, pl. ii. fig. 3, 4.

The teeth are peculiarly modified.

Bulimulus sufflatus, Gould. Am. Journ. Conch., VI. 209, pl. ix. fig. 8, 13.

Bulimulus Marielinus, Poey. Am. Journ. Conch., VI. 209. Jaw alone.

Bulimulus Jonasi, Pfr. Am. Journ. Conch., VII. 182, as in *B. aureolus*.

Bulimulus aureolus, Guppy. Am. Journ. Conch., VII. 181.

Lingual membrane as in *B. laticinctus*. Jaw not examined.

Bulimulus alternatus, Say. Am. Journ. Conch., VII. 181.

Bulimulus membranaceus, Phil. Am. Journ. Conch., VII. 182.

Teeth as in *B. laticinctus*.

Bulimulus dealbatus, Say. Am. Journ. Conch., VII. 182. Jaw only.

Bulimulus Berendti, Pfr. Am. Journ. Conch., VII. 182.

The species referred to proves to be *B. corneus*, Sow.

Bulimulus durus, Spix. Am. Journ. Conch., VII. 182.

Cylindrella subula, Fér. Am. Journ. Conch., VII. 183.

Cylindrella seminuda, Ad. Am. Journ. Conch., VII. 184.

Cylindrella rosea, Ad. Am. Journ. Conch., V. 37, pl. xi. fig. 2, photograph.

Cylindrella scæva, Gundl. Ann. Lyc. N. H. of N. Y., VIII. 161, fig. 4. Lingual membrane only. Ibid. IX. 77. T. Bland.

Cylindrella Blandiana, Pfr. Ann. Lyc. N. H. of N. Y., IX. 85, fig. 5. T. Bland.

Cylindrella trinitaria, Pfr. Am. Journ. Conch., IV. 187, fig. T. Bland. Jaw first noticed, also jaw described in *C. rosea*, *sanguinea*, *brevis*, *Maugeri*, *gracilis*, *elongata*, *Bahamensis*, *scæva*, *Elliotti*, *Brooksiana*.

Macroceramus Gossei, Pfr. Am. Journ. Conch., VII. 187, pl. xvii. fig. 9, 11, 12.

Teeth quite different from the form usual in *Cylindrella* and *Macroceramus*.

Macroceramus signatus, Guild. Ann. Lyc. N. H. of N. Y., VIII. 162, fig. 5, 6. Ibid. IX. 84. T. Bland.

Pineria Viequensis, Pfr. Ann. Lyc. N. H. of N. Y., X. 26.

Lingual membrane entirely distinct from *Pupa*, where it is placed by von Martens.

- Patula strigosa**, Gould. Proc. Phila. Ac. N. Sc., 1872, 135.
- Patula Idahoensis**, Newc. Same as last, 136.
- Patula Cooperi**, W. G. Binn. Same as last, 136.
- Patula perspectiva**, Say. Same as last, 136.
- Patula solitaria**, Say. Am. Journ. Conch., VII. 176.
- Patula Hemphilli**, Newcomb. Am. Journ. Conch., VI. 207, pl. ix. fig. 3.
- Patula Cooperi**, W. G. Binn. Am. Journ. Conch., VI. 207. Jaw.
- Sagda connectens**, Ad. Am. Journ. Conch., VII. 175.
- The marginal teeth are quadrate, not aculeate, proving the genus to belong to the *Helicea*, not to the *Vitrinea*.
- Sagda Haldemaniana**, Adams. Am. Journ. Conch., VII. 175. See last species.
- Sagda Jayana**, Adams. Ann. Lyc. N. H. of N. Y., X. 219. See last species.
- Helix circumfirmata**, Redf. (*Microphysa*.) Ann. Lyc. N. H. of N. Y., X. 221.
- The species shown to belong to the *Vitrininae*.
- Helix turbiniformis**, Pfr. (*Microphysa*.) Ann. Lyc. N. H. of N. Y., X. 79, pl. ii. fig. 2.
- Jaw unusual in the genus—resembling that of *Bulimulus*.
- Helix Boissieri**, Charp. (*Leucochroa*.) Ann. Lyc. N. H. of N. Y., X. 220.
- The species shown to be more nearly related to *Helix* than to any of the *Vitrininae*.
- Helix Yatesii**, J. G. Cooper. (*Gonostoma*.) Am. Journ. Conch., VII. 176.
- Helix polygyrella**, Bland and Cooper. (*Polygyrella*.) Proc. Phila. Ac. N. Sc., 1872, 136.
- Helix microdonta**, Desh. (*Polygyra*.) Am. Journ. Conch., VI. 205.
- Helix septemvolva**, Say. (*Polygyra*.) Am. Journ. Conch., VI. 206.
- Helix fastigans**, L. W. Say. (*Polygyra*.) Am. Journ. Conch., VII. 176.
- Helix stenotrema**, Fer. (*Stenotrema*.) Am. Journ. Conch., VI. 207.
- Helix loricata**, Gould. (*Triodopsis*.) Am. Journ. Conch., VI. 206.
- Helix inflecta**, Say. (*Triodopsis*.) Am. Journ. Conch., VI. 206.
- Helix palliata**, Say. (*Mesodon*.) Proc. Phila. Ac. N. Sc., 1872, 136.
- Helix obstricta**, Say. (*Mesodon*.) Same as last, 136.
- Helix devia**, Gould. (*Mesodon*.) Proc. Phila. Ac. N. Sc., 1872, 136.
- Helix similis**, Fér. (*Dorcasia*.) Am. Journ. Conch., VII. 176.
- Helix Newberryana**, W. G. B. Am. Journ. Conch., VII. 190, pl. xvii. fig. 3, 4.

Helix fidelis, Gray. (*Aglaia*.) Am. Journ. Conch., VI. 207, pl. ix. fig. 1, 9.

Jaw said to be ribless, but a better specimen found normal, Proc. Phila. Ac. N. Sc., 1872, 136.

Helix redimita, W. G. Binn. (*Arionta*.) Am. Journ. Conch., VI. 206, pl. ix. fig. 11.

Helix tudiculata, Binney. (*Arionta*.) Am. Journ. Conch., VI. 208, pl. ix. fig. 7.

Helix Townsendiana, Lea. (*Arionta*.) Am. Journ. Conch., VI. 206.

Helix reticulata, Pfr. (*Arionta*.) Am. Journ. Conch., VII. 177.

Helix Nickliniana, Pfr. (*Arionta*.) Am. Journ. Conch., VII. 177.

Helix Tryoni, Newc. (*Euparypha*) jaw, W. G. B. Am. Journ. Conch., I. 93, pl. vi. fig. 2-10.

Showing variation in number of ribs.

Helix Gossei, Ad. (*Coryda*.) Am. Journ. Conch., VII. 177. Lingual membrane only.

Helix aspera, Fer. (*Thelidomus*.) Am. Journ. Conch., VI. 204.

Helix notabilis, Shuttl. (*Thelidomus*.) Am. Journ. Conch., VII. 177. Lingual membrane only.

Helix pemphigodes, Pfr. (*Cysticopsis*.) Am. Journ. Conch., VII. 177. Lingual membrane only.

Helix tumida, Pfr. (*Cysticopsis*.) Ann. Lyc. N. H. of N. Y., IX. 283, fig. 3, lingual.

Jaw, different from generic description, figured in Am. Journ. Conch., VI. 203, fig. 2.

Helix loxodon, Pfr. (*Plagioptycha*.) Am. Journ. Conch., VII. 177.

Unlike the generic description, the jaw has a median projection, and is ribless.

Helix diaphana, Lam. (*Plagioptycha*.) Am. Journ. Conch., VII. 178. See last species.

Helix monodonta, Lea. (*Plagioptycha*.) Am. Journ. Conch., VII. 178. See last.

Helix Albersiana, Pfr. (*Plagioptycha*.) Amer. Journ. Conch., VII. 178. Jaw same as in last species.

Helix macroglossa, Pfr. (*Plagioptycha*.) Am. Journ. Conch., VII. 178.

Jaw with median projection and no anterior ribs.

Helix varians, Mke. (*Polymita*.) Am. Journ. Conch., VI. 206, lingual.

Helix muscarum, Lam. (*Polymita*.) Am. Journ. Conch., VI. 204, pl. ix. fig. 4, 16.

Jaw ribless, lingual widely differing from the usual type of *Helix*.

Helix graminicola, Ad. (*Polymita*.) Amer. Journ. Conch., VII. 178.

Jaw different from generic description of *Helix* in having no anterior ribs—and in having a median projection to its cutting edge.

Helix crispata, Pfr. (*Eurycratera*.) Am. Journ. Conch., VII. 179.

Helix orbiculata, Fér. (*Dentellaria*.) Am. Journ. Conch., VI. 205, pl. ix. fig. 14. Jaw apparently costate.

Helix Isabella, Pfr. (*Dentellaria*.) Am. Journ. Conch., VII. 179. Jaw surely costate.

Helix dentiens, Fér. (*Dentellaria*.) Am. Journ. Conch., VII. 179. Jaw as in last.

Helix perplexa, Fér. (*Dentellaria*.) Ann. Lyc. N. H. of N. Y., X. 221. Jaw with traces of anterior ribs, but with a median projection to its cutting edge.

Helix Schroeteriana, Pfr. (*Pleurodonta*.) Am. Journ. Conch., VII. 179.

Lingual membrane alone examined.

Helix acuta, Lam. (*Pleurodonta*.) Am. Journ. Conch., VI. 204.

Helix excellens, Pfr. (*Caracolus*.) Am. Journ. Conch., VII. 180. Lingual membrane only examined.

Helix Bermudensis, Pfr. (*Caracolus*.) Ann. Lyc. N. H. of N. Y., X. 221.

The species shown to belong to the *Vitrininae*.

Helix fuscocincta, Ad. (*Leptoloma*.) Am. Journ. Conch., VII. 180. Jaw unlike generic description in having a median projection and no ribs.

Helix Phoenix, Pfr. (*Acavus*.) Am. Journ. Conch., VII. 180. Jaw with no anterior ribs.

(c.) *With jaw in separate pieces.*

Liguus virgineus, Lin. Am. Journ. Conch., VI. 209, fig. 3, 4, lingual membrane.

Liguus fasciatus, Müll. Am. Journ. Conch., VI. 211, pl. ix. fig. 6.

Orthalicus zebra, Müll. Am. Journ. Conch., VI. 212, pl. ix. fig. 2.

Orthalicus undatus, Brug. Am. Journ. Conch., VI. 213, pl. ix. fig. 10, 12.

(d.) *With jaw with supplementary upper plate.*

Succinea effusa, Shuttl. Am. Journ. Conch., VI. 213, pl. ix. fig. 15.

Succinea Nuttalliana, Lea. Ann. Lyc. N. H. of N. Y., IX. 282, fig. 1.

PULMONATA LIMNOPHILA.

Limnæa appressa, Say. Am. Journ. Conch., VII. 161, pl. xii. fig. 1, 2, 5.

Limnæa megasoma, Say. Am. Journ. Conch., VII. 162, pl. xii. fig. 3, 6.

Pompholyx effusa, Lea. Ann. Lyc. N. H. of N. Y., IX. 290, fig. 9.—Amer. Journ. Conch. VI. 312, pl. xviii.

Planorbis trivolvis, Say. Ann. Lyc. N. H. of N. Y., IX. 292, fig. 10.

Melampus bidentatus, Say. Ann. Lyc. N. H. of N. Y., IX. 286, fig. 7.

PECTINIBRANCHIATA.

Geomelania. Am. Journ. Conch., VII. 185, pl. xvii. fig. 7, 10.

Blandiella reclusa, Guppy. Am. Journ. Conch., VII. 185, pl. xvii. fig. 5.

Cyclotus stramineus, Rve. Am. Journ. Conch., I. 45, pl. v. fig. 1, 4. T. Bland. Jaw and teeth.

Megalomastoma cylindraceum, Chemn. Am. Journ. Conch., I. 45, pl. v. fig. 2, jaw. T. Bland.

Megalomastoma Antillarum, Sowb. Same as last, fig. 3, teeth. T. Bland.

Megalomastoma bituberculatum, Sowb. Am. Journ. Conch., VI. 213, fig. 6.

Tulotoma magnifica, Conrad. Ann. Lyc. N. H. of N. Y., IX. 293, fig. 11.

SCUTIBRANCHIATA.

Stoastoma pisum, Ad. Am. Journ. Conch., VII. 184.

Helicina occulta, Say. Ann. Lyc. N. H. of N. Y., IX. 287, fig. 8.—Am. Journ. Conch., VII. 29, pl. ii. fig. 6.

Helicina orbiculata, Say. Am. Journ. Conch., VI. 214, pl. ix. fig. 5.

From the observations we have catalogued above, it appears that the jaw cannot be depended upon as a generic character in the genus *Bulimus*, as constituted in the second edition of Die Heliceen. We have found it strongly ribbed, with ribs as described below in *Bulimulus*, ribless, and ribless with a decided median projection to its cutting edge. In *Limicolaria* the jaw is described with ribs, we find it ribless in one species. In *Bulimulus*, von Martens describes the jaw as composite. We have shown it to be in one single piece, though divided by delicate ribs into numerous plate-like sections. The jaw is also very thin and transparent. This form of jaw seems constant in *Bulimulus*. It is also found in *Cylindrella*, *Macroceramus*, *Amphibulima*, *Gæotis*, and even in *Helix* (*H. turbiniformis*). The tendency to an upper triangular median plate is more or less seen in this form of jaw—its greatest development being in *Cylindrella*.

In the genus *Helix* as constituted by von Martens, the jaw is said to be ribbed, but we have found every variety of jaw except that with an upper additional plate, and that with free imbricated plates as in *Orthalicus*. We believe, however, that the form of jaw is constant in all the species of each section or subgenus of

Helix. Thus we have found the jaw alike in all the species we have examined of *Patula*. So of *Sagda*, *Polygyra*, *Mesodon*, *Arionta*, *Stenotrema*, *Triodopsis*, *Plagioptycha*, *Polymita*, *Dentelaria*.

It appears to us, therefore, that we may hope to find a reliable generic character in the jaw, when the present subgenera, or some of them at least, are recognized as distinct genera. On account of the gradations in the ribs and median projection, we have elsewhere¹ suggested that for the purpose of grouping the genera into subfamilies, we may depend only upon the following distinctions in the jaw.

- (a.) Jaw in one piece.
- (b.) Jaw in separated, imbricated pieces.
- (c.) Jaw in one piece with an upper accessory plate.

As regards the lingual dentition, it appears that the distinction, as far as the central and lateral teeth are concerned, is but slight between the various families and genera. The marginal teeth, however, give us two very distinct types, the aculeate and quadrate.

The former is found either unaccompanied by a jaw, or by its simplest form. Up to this date no instance is on record of aculeate marginal teeth together with a jaw complicated by anterior ribs, free imbricated plates, or an upper accessory plate. The presence of aculeate marginal teeth is usually (not always) indicated by a smooth, shining shell, with acute peristome. The shell, however, is not always reliable as an indicator of the form of marginal teeth, for we have shown the rough shells of several Mauritius species to have a lingual membrane with aculeate marginal teeth. It appears, therefore, that the shell alone will not indicate the generic position of some species.

The quadrate marginal teeth are accompanied by various forms of jaw. They are usually constant in shape in the various genera. Sometimes, however, we have met with unexpected variation—such as in *Macroceramus Gossei*, *Helix muscarum*, and a group of *Bulimulus* represented by *B. lalicinctus*.

The form of jaw with free, imbricated plates seems (excepting in *Punctum*) constantly accompanied by a peculiar form of quadrate teeth, as in *Orthalicus* and *Liguus*. To our surprise, however, we have detected a somewhat similar form of teeth in *Gæotis*,

¹ Ann. Lyc. N. H. of N. Y., X. 163.

whose jaw is like that of *Bulimulus*.¹ It seems, therefore, that the lingual dentition is less reliable as a generic character than the jaw, at least in cases where the aculeate marginal teeth are absent.

Finally, we are convinced that most satisfactory results will follow the patient investigation of the jaw and lingual dentition of the *Geophila*. Although we have in many cases proved the distinctions, which have been based on them, to be unreliable, we believe that a further accumulation of facts will lay the foundation of a natural and generally acceptable classification.

EXPLANATION OF PLATE I.

Fig. 1. The jaw of *Helix Newberryana* (see page 244).

Fig. 2. Genitalia of *Helix infumata*. See references to fig. 5, except 9, the duct of the genital bladder.

Fig. 3. Genitalia of *Helix Newberryana*. Same references as in 5, excepting 12, probably a rudimentary dart sac, for which see page 245. The names of the organs are the same as used by Dr. Leidy in the plates of Vol. I. of Dr. Binney's *Terrestrial Air-breathing Mollusks of the United States*.

We failed to detect any accessory gland of the epididymis. The epididymis is very long, convoluted in the lower half of its length, straight above. It runs free for a long distance outside the membrane which covers the oviduct, before entering into the liver, where it joins the testicle. The latter is imbedded in the liver, near its upper extremity. It is composed of several, apparently six, separated fasciculi of blind tubes. The vas deferens enters the penis about its middle, not at its end. The penis is small, cylindrical. There is no trace of lobuli in the ovary, but its under, concave surface is reticulated. The genital bladder is oval, its duct is long, free only for a short distance, then attached to the oviduct the whole length of the latter; at its base it becomes again free, and enters the vagina below the terminus of the oviduct. At about the same point, the vagina receives the mouth of a long, broad, rounded organ, (12 of fig. 3). This organ is hollow. Its use is unknown to us, it may be a dart sac, or a prostate gland.

¹ We are about publishing this in the *Ann. N. Y. Lyc. of N. H.*, 1873, X. 251, pl. xi. fig. 5.

The vagina is very long, the penis enters it at its lower extremity near the exterior opening of the genitalia.

For the sake of comparison, we have also given figures of the genitalia of two other Pacific subgenera, *Arionta* and *Aglaja*. In *Helix Townsendiana*, Lea (*Arionta*), see plate I. fig. 4, we detected the accessory gland of the epididymis (3), composed of several acini of different sizes. The genital bladder is lengthened oval (9), and differs greatly from that of *Helix Newberryana* in having a very short, stout duct. At the opening of the penis there is a decided enlargement, perhaps of the nature of a prepuce, or prostate. The vas deferens enters the penis below its apex. The retractor muscle is at the apex of the penis. There seems no accessory organ, the genitalia being reduced to their simplest type.

Of *Aglaja* we have examined two species, *H. fidelis*, Gray, and *H. infumata*, Gould. The genitalia of these are almost exactly similar. In neither have we detected any accessory gland to the epididymis. In both the penis is extended into a decided flagellum (15). The vas deferens (7) enters below the flagellate extension (15). The retractor muscle (6) is attached on the opposite side and still lower down. There is a well-marked prepuce (12). Opposite the entrance of the penis on the other side of the vagina, which is here considerably swollen, is a small sac-like organ (14), ending in a smoothly rounded cul-de-sac, of what use in the economy of the animal is unknown to us, unless it be a rudimentary dart sac. There was no appearance, however, of a dart within it. Just above this organ opens the stout duct of another organ (13), cylindrical, bluntly pointed, hollow, of a reticulated appearance. There is a contraction where this organ joins its duct, which is of about the same size. The two together are about as long as the penis with its flagellum, and stouter. No dart was noticed within this organ. It is, no doubt, a form of vaginal prostate, as described by Moquin Tandon. The genital bladder (9) is globular. Its duct is long, free in the upper half of its course. The oviduct, ovary, genital bladder, testicle, etc., of *H. infumata*, fig. 2, are not figured by us. They are as in *H. fidelis*, fig. 5, excepting the testicle, which is as in *H. Newberryana*.

Fig. 4. Genitalia of *Helix Townsendiana*, Lea. Same reference as in Fig. 5, excepting 3, the accessory gland of the epididymis.

Fig. 5. Genitalia of *Helix fidelis*, Gray.

1. Testicle.
2. Epididymis.
4. The prostate gland.
5. The sac of the penis.
6. The retractor muscle of penis.
7. The vas deferens.
8. The oviduct.
9. The genital bladder.
10. The exterior orifice of genitalia.
11. The ovary.
12. The prepuce.
13. Vaginal prostate.
14. Rudimentary dart sac?
15. The flagellum, which contains a capreolus.
16. The duct of the genital bladder.